"Application of AutoCAD Civil 3D in Rotary Intersection Design"

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ABSTRACT: Transportation has continuously evolved to meet the increasing demand for safe, efficient, and convenient travel. The development of highways has significantly improved connectivity between locations; however, the rise in vehicle speed and traffic volume has also increased the risk of road accidents and traffic congestion, particularly at intersections. One effective solution to these challenges is the construction of rotary (roundabout) intersections, which help regulate traffic flow, minimize conflict points, reduce accident rates, and provide safer crossing opportunities for pedestrians.

This study focuses on the geometric design of a rotary intersection using AutoCAD Civil 3D software and compares the process with conventional manual design methods. The objective is to demonstrate that Civil 3D enables faster, more accurate, and cost-effective intersection design while producing reliable engineering reports. In contrast, manual design requires more time, greater effort, and is more prone to errors.

AutoCAD Civil 3D integrates design, drafting, and 3D visualization into a single platform, allowing engineers to efficiently create, modify, and analyze highway intersection layouts. The software supports the preparation of earthwork reports, 3D models, and design alternatives for both small- and large-scale infrastructure projects, resulting in reduced project time and cost. Its advanced visualization capabilities also improve design understanding and decision-making during project planning.

A rotary intersection is a type of at-grade intersection in which vehicles circulate around a central island in a single direction. Under left-hand traffic conditions, approaching vehicles enter the rotary, travel around the central island, and exit smoothly toward their intended destinations. Proper geometric design of such intersections enhances traffic efficiency, improves road safety, and ensures economical construction. This study highlights the practical application and advantages of AutoCAD Civil 3D in designing modern rotary intersections for highway engineering projects.

Keywords: AutoCAD Civil 3D, Rotary Intersection, Geometric Design, Highway Engineering, 3D Modeling, Earthwork Report.

INTODUCTION: Highways play an important role in making travel easier and more expedient. This is of great assistance whether travelling for work or play as well as travel involved transporting goods. Highway systems have made expansion possible, provided a convenient means to travel for more lucrative career opportunities, and allowed businesses to expand and grow nationwide. Highway transportation is especially important when it comes to the economy. A large number of companies and corporations rely on the expedience of delivery of their goods and services over the road in order to compete in the fast-paced business world. Highway provide the quickest route from point A to point B, meaning that those who must use this method of delivery will need to utilize the fastest and most direct means of road travel. The highway system becomes very important. Since time equals money the shortest, most direct route will prove to be the most lucrative.

Our highway also contributes greatly to social growth and relation. Families are able to visit one another more easily and frequently, go on special trips and vacations, and travel for reason other than work related activities. Trips taken via highway mean less time spent on the road and more time spent enjoying more fun activities with family and friends. In fact, there are some locations that are only accessible via highway between smaller rural route and country back roads. Thanks to the highway system, nearly any location in the country is accessible by a route connected to the highway. Highway system is essential for successful growth and development in any country. There was a time when even emergency services were unavailable to those who lived in more outlying areas because there simply were no decent roads. A heavy rainstorm or a few inches of snow could cost people living off dirt roads. Their lives in an emergency situation. Thanks to modern highway, there is hardly any place that is not accessible today. People who were for all intents and purpose cut off from just about everywhere are no longer isolated and are able to reach places like grocery stores, doctors' offices, hospitals, etc. as well as going from place to place to visit. Highway plays a major part in the growth and development of countries all over the world. One of the most important performance characteristics of the highway is its traffic capacity that is the maximum number of automobiles that can travel without causing a traffic jam on a given section of the highway in a given span of time for instance in one hours.

The magnitude of the traffic capacity depends on the width and number of the lanes the radius of the curves the gradient the type of vehicles the traffic speed and the weather. An efficient road transport system is a pre requisite for sustained economic development. It is not only the key Infrastructural input for the growth process but also plays a significant role in promoting national integration which is particularly important in India.

ABOUT ROTARY INTERSECTION

Intersection is an area shares by two or more roads. This area is designated for the vehicles to turn to different directions to reach their desired destinations. Intersections must be designed and operated for simplicity and uniformity. The design must keep the capabilities and limitation of drivers, pedestrians and vehicles using intersection. It should be based on knowledge of what a driver will do rather than what he should do. Further all the traffic information on road signs and markings should be considered in the design stage, prior to taking up construction work. All the intersection movements should be obvious to the drivers, even if he is a stranger to the area. Complex design which requires complicated decision-making by drivers should be avoided. There should be no confusion and the path to be taken by the drivers should be obvious. Undesirable short cuts should be blocked.

Further, on an average trip route, all the intersections should have uniform design standards so that even a newcomer to the area anticipates what to expect at an intersection. Some of the major design elements in which uniformity is required are design speed, intersection curves, vehicle turning paths, super elevations, level shoulder width, speed change lane lengths, channelization types of curves and type of signs and markings. Traffic intersections are complex locations on any highway. This is because vehicles moving in different direction wan to occupy same space at the same time. In pedestrians also seek same space for crossing. Drivers have to make split second decision at an intersection by considering his route, intersection geometry, speed and direction of other vehicles. A small error in judgment can cause severs accidents. It also causes delay and it dependant on type geometric and type of control. Overall traffic flow depends on the performance of the intersections. It also affects the capacity of the road. Therefore, both from the accident perspective and the capacity perspective the study of intersections very important for the traffic engineering especially in the case of urban scenario.

TRAFFIC OPERATIONS IN A ROTARY INTERSECTION

As noted earlier, the track operations at a rotary are three; diverging, merging and weaving. All the other conflicts are converted into these three less severe conflicts.

i. Diverging: It is a track operation when the vehicles moving in one direction is separated into different streams according to their destinations.

ii. Merging: Merging is the opposite of diverging. Merging is referred to as the process of joining the track coming from different approaches and going to a common destination into a single stream.

iii. Weaving: Weaving is the combined movement of both merging and diverging movements in the same direction.

iv. Conflict Point: conflict point is the intersecting point between different traffic movement paths. Traffic conflict points can be grouped into crossing, merging, and diverging types.

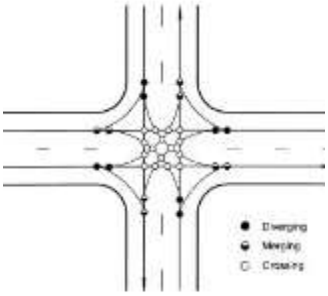

Fig. Conflicts with two-way traffic

ABOUT AUTOCAD CIVIL 3D

AutoCAD Civil 3D software is a design and documentation solution for civil engineering that supports building information modelling (BIM) workflows. By learning to use AutoCAD Civil 3D, you can improve project performance, maintain consistent data, follow standard processes, and respond faster to change. Civil 3D is an engineering software application used by civil engineers and other professionals to plan, design, and manage civil engineering projects. These projects fall under the three main categories of land development, water, and transportation projects; and can include construction area development, road engineering, river development, port construction, canals, dams, embankments, and many others. Civil 3D allows is used to create three-dimensional (3D) models of land, water, or transportation features while maintaining dynamic relationships to source data such as grading objects, break lines, contours, and corridors. As industry-leading building information modelling (BIM) solution, Civil 3D is well known in the civil engineering community and widely used on a variety of infrastructure projects both large and small. AutoCAD Civil 3D is a software application used by civil engineers and professionals to plan and design the projects for building constructions, road engineering projects, water include construction of dams, ports, canals, embankments etc. AutoCAD civil 3D associate design and production drafting, greatly reducing the time it takes to implement design changes and evaluate multiple situations. A change made in one place immediately updates an entire project, helping your complete projects faster, smarter and more accurately. Civil 3D provides to create 3D models of the project and helps to adopt for both small- and large-scale projects. It helps to imagine the things in 3D visualization, reduces the time and budget. It also inherits many benefits of using civil

3D. Total station is a combination of electronic distance measurement (EDM), an electronic digital theodolite, and a computer in one unit used to measure horizontal angles, vertical angles and sloping distances of the objects. It takes a part by providing all the three co-ordinates of the observed points that is northing, easting, and elevation. These points are further transferred into AutoCAD civil 3D. The main aim of this project is to exemplify the proposed road alignment in a comfortable way using AutoCAD civil 3D. Tabular columns for curves, profile section will generate automatically. Gradually Volume Report sheet is generated. By using total station survey can be carried out rapidly and can truncate the time. Total station is a nifty for importing the points in AutoCAD civil 3D which is in the form of x, y, z co-ordinates that is latitude, longitude and elevation. These co-ordinates of the ground will generate and helps to design the alignment in the AutoCAD.

APPLICATION OF MX ROAD SOFTWARE

MX Road can be used on a wide variety of highway projects, from corridor studies to municipal street schemes, commercial building, plant and manufacturing sites to airports, rail terminals, and drainage, utility and floodplain projects. At its core MX Road V8 XM Edition uses 3D string modelling technology – approve powerful and concise method of creating any 3D surface. Localized in all key markets, MX Road has an interoperable database that allows engineers to create and annotate 3D project models in the most popular CAD platforms and in a Stand-Alone version which has fully functional, high quality CAD tools built in. Digital Terrain Model (DTM) creation and analysis, full alignment, road and junction design capability, 2D and 3D drainage design, volume and quantity extraction, 2D and 3D PDF creation, integration with Google Earth and automated production of contract drawings, complete a tool set that allow MX Road users to feel confident tackling the design of any type of road, large or small.

OBJECTIVES

The study will be undertaken with the following objectives.

i. To study traffic volume of located area.

ii. To study application of the AutoCAD Civil 3D.

iii. To decide road alignment using ground data for a rotary intersection design.

iv. To estimate earthwork using AutoCAD Civil 3D.

LITERATURE REVIEW:

Matthew et al (2001) studying on relationship between rural road geometric characteristics, accident rates and their prediction, using a rigorous non-parametric statistical methodology known as hierarchical tree based regression. Their goal is twofold; first, it develops a methodology that quantitatively assesses the effects of various highway geometric characteristics on accident rates and second, it provides a straightforward, yet fundamentally and mathematically sound way of predicting accident rates on rural roads. The results show that although the importance of isolated variables differs between two lane and multilane roads, ‘geometric design’ variables and ‘pavement condition’ variables are the two most important factors affecting accident rates.

Bhatt (2003) studied that increasing trends of traffic in urban area is a major concern in all the cities in India. The heterogeneous traffic are more diverse in nature due to lane changing and lack of lane discipline characteristics of driver’s in India. The rotary intersections are of the most vital components of urban roadway network. Intersection is one when either three or more road meets or intersects each other.

Arora et al (2005) studied that Rapid urbanization and industrialization has led to substantial increase in urban traffic. Thus, congestion on urban road is a common phenomenon in cities. India is also facing the problem. Chandigarh, a Union Territory of India was planned by Le Croupier’s and the city also known for its beautiful roundabouts. But these roundabouts become place of slow-moving traffic during peak hours. Traffic flow occurs at these intersections especially during the peak hours. This heavy traffic leads to congestion at both these intersections and also the flow of traffic is not smooth between these two intersections.

Shrirame et al (2007) studied that Traffic Rotary at road intersections is special form of grade change of lanes to channelize movement of vehicles in one direction around a central traffic island. With rapid growth of traffic, it was experienced by them that widening of roads and providing flyovers have become imperative to overcome major conflicts at intersections such as collision between through and right turn movements. In this way, major conflicts are converted into milder conflicts like merging and diverging. The vehicles entering the rotary are gently forced to move in a clockwise direction. They then weave out of the rotary to the desired direction.

By studying the paper of Shrirame V.B and Nagoshe S.R it is clear that Rotaries are suitable when the traffic entering from three or more approaches are relatively equal. A total volume of about 3000 vehicles per hour can be considered as the upper limiting case and a volume of 500 vehicles per hour is the lower limit. Rotaries are suitable when there are more approaches and no separate lanes are available for right-turn traffic thus making intersection geometry complex. His paper work also explains us that the traffic operations at a rotary are three; diverging, merging and weaving. All the other conflicts are converted into these three less severe conflicts.

Ali Aram (2010) studied that safe factors on the horizontal curve of two-lane highway and added that horizontal curves have higher crash rates than straight section of similar length and traffic composition and it's particularly significant at radius below 200m. Golakati(2015) study to consider a geometric feature of a road such as horizontal radius, superelevation, K-value, visibility, etc and carries out a regression analysis for his study be to conclude that geometric feature has to be given more important while designing a road.

Liao Chen-Fu (2011) studied that use of the highway geometric design package road. The online tool helps students better understand the different aspects of geometric design as compared to the traditional approach. The objective of incorporating road into the teaching of geometric design is not to reduce or ignore the importance of the underlying equations, calculations, or theory. The goal is to help students better understand the challenges of geometric design that transportation engineer faces. Since fall 2006, a homework exercise has been assigned to students to design single-curve roadway geometry by hand prior to the lab project. The exercise prepares students to

understand the equations and calculations of geometric design and its process. The author's hope that, through the assistance of road can better understand the procedures that transportation professionals take in order to perform geometric design. And through the use of road can explore different geometric designs that can satisfy given design constraints and requirements in real-world applications.

Blessing Alexander (2013) studied that suitability of these modalities for road design, which makes heavy use of two-dimensional visual representations. They have implemented a multimodal road design interface that combines sketching and speech. Their system allows designers to specify spatial and geometric aspects of their design using a pen-based interface that can recognize user input interactively in real-time. They evaluated the usability of system for the task of designing driving courses for the STISIM driving simulator. Their initial evaluation with four users suggests that users find their multimodal interface to be superior to conventional methods.

Hameed Aswad Mohammed (2013) studied that shoulder wider than 2.25m give additional safety. Average single vehicle accident rate for highway curves is about four times the Average single vehicle accident rate for highway tangents. Horizontal curves are more dangerous when combined with gradients and surfaces with low coefficient of friction. There is only a minor decrease in the speed adopted by drivers approaching curves of radii which are significantly less than the minimum radii specified for the design speed. Horizontal curves are more dangerous when combined with gradients and surfaces with low coefficient of friction. Horizontal curves have higher crash rates than straight sections of similar length and traffic composition. The difference becomes apparent at radii less than 1000m. The increase in crash rates becomes particularly significant at radii below 200m. Small radius curves result in much shorter curve lengths and overall implications for crashes may not be as severe as would first appear.

Rahil et al (2014) studied that three approaches to relate accident rate to geometric characteristics and traffic related explanatory variables: Multiple Linear regression, Poisson regression and Negative Binomial regression. Various models have been intensively tested and validated. The adjustment of the models is based on historical accident data and on the characteristics of experimental sections selected from the road network. For example, Multiple linear and Poisson regression were used. In order to estimate accident rates using traffic and geometric independent variables. Moreover, developed a model to identify the most significant traffic and geometric elements in predicting accident frequency. They used both the Poisson and negative binomial regression models. It should be pointed that, in using such models for future forecast one has to be careful as this entails extrapolating outside the range where the real observations were made. These models can be used for short-term forecast of 1–3 years. It is advisable that whenever data is available, these models should be updated through recalibration

Asok et al (2015) studied that for designing geometric elements designing MX ROAD software is high design precision and saving time. thesis includes geometric factors of road and data collection and analysis of geometric parameters. The aim of this study is to find the role of the geometric factors of road on accident rate in the case of plain terrain and also find the extent to which these factors affect the accident rate for rural areas. The study aims to find the impact of factors like extra widening, horizontal radius, sight distance, K-value, super elevation, horizontal arc length, vertical arc length, vertical gradient on the accident rate and aims to study the significant factors

causing accidents and to find the values for future design of roads. American Association of State Highway and Transport Officials (2005). This policy states standards for highway designing elements. In addition to that vertical clearance, cross-section, structural capacity of bridges and about tunnels. Government of the People's Republic of Bangladesh Ministry of Communications Roads and Railways Division (2000). It states design standards for different road classifications, traffic volume and capacity, design speed, and sight distances along with design procedure. Indian Road Congress 73:2005.

Neeraj et al (2015) study on the geometric design of highway. Each factor describes to his function of geometry design and planning factor. To initial alignment is proposed then lock about the traffic in the road and there topographic. Always traffic factor is the main part of the design the alignment, the traffic growth consideration the future growth of traffic flow and possibility of the road being upgraded to a higher category or to a higher design speed standard at a later stage as it is very expensive and rather difficult to improve the geometric elements of a highway in stages at a later date. Their study was mainly emphases on the importance of planning and design of geometric feature of the highway during the initial alignment itself taking into consideration the future growth of traffic flow and possible of the road upgrading to higher categories. emphasized on the importance of planning and designing of geometric features of the highway during the initial alignment itself taking into consideration the future growth of traffic flow and possibility of the road being upgraded to a higher category1 or to a higher2 design speed standard at a later stage as it is very expensive and rather difficult to improve the geometric1 elements of a 1highway in stages at a later date

Shah et al (2016) studied that planning and design of purposed bypass road used civil 3D and carries out a capacity analysis by projection traffic volume data for 15 years and concluded that high design precision and saving in time were achieved by using Autodesk Civil 3D.

Vayalamkuzhi et al (2016) studied that Influence of geometric design characteristics on safety under heterogeneous traffic flow. They found that Operating speed, access point, median opening and horizontal curvatures (inverse radius) are identified as the significant factors influencing road crashes in a divided highway under heterogeneous traffic using the same carriageway.

Nazimuddin et al (2017) study on the geometric design of highway using MX ROAD and achieved high design precision and prepare the alignment to cost-saving and accuracy for given set of data.

Raghu veer et al (2018) studied that about the alignment properties and safety purposed. It's disused about the same papers which base of the road, 2.5m shoulder wide addition safety, and curves should provide the sufficient length. The second one talked about formulas in pavement widening on horizontal curves. To prevent off tracking, extra widening of pavement is provided at horizontal curves which are called mechanical widening. Third paper discuss about fuel consumption development model based on highway geometric characteristics like grades, length, and location of crest& vertical curves, speed& road surface type& condition. Fourth MX Road software is the preferable and optimistic one for designing highway. So that it has default values for classification of factors influencing the design of highway. Its mean all papers are discuses explained the geometric design of highway considering various geometric elements such as alignment, profile, cross- section, etc and concluded that horizontal curve at grade separation is more dangerous and causes 30% of more accidents.

Nisarga et al (2018) studied that geometric design of rural road using AutoCAD civil 3d. They explained that Geometric design plays a major role in every road and it is weighty in the road alignment. AutoCAD Civil 3D is a software application used by civil engineers and professionals to plan and design the projects

& change made in one place immediately updates an entire project, helping your complete projects faster, smarter and more accurately

RESEARCH METHODOLOGY

EXISTING DESIGN OF ROTARY INTERSECTION

A rotary intersection is a specialized form of intersection-at-grade in which the traffic movies in one direction round a central island. For 'keep-to-the-left' rule, vehicles approaching the intersection are forced to move around the central island in an orderly manner and weave out of the rotary into their respective desired directions.

A number of elements of a rotary are considered herein. The guidelines given are in accordance with the Recommended Practice for Traffic Rotaries, IRC: 65 – 1976, Indian Roads Congress, New-Delhi, 1976.

DESIGN SPEED

Various elements such as radii and weaving lengths are governed by the design speed. This should be necessarily lower than the design speed of the intersecting highways so as to keep the dimensions within practical limits. The IRC recommended values are 40 km/h in rural areas and 30 km/h in urban areas.

ENTRY RADIUS

This is determined by the design speed, super elevation and coefficient of pavement friction. This should be such as to result in the drivers lowering their speed to the design speed of the rotary. IRC recommends an entry radius of 20 to 35 m for rural areas and 15 to 25 m for urban rotaries.

EXIT RADIUS

This should be larger than that of the rotary island for the drivers to leave the rotary rapidly. The recommended practice is to keep the exit radius 1.5 to 2 times more than that of the entry radius. However, the exit radius may be kept similar to the entry radius in case the pedestrian traffic across the exit road is high, in order to limit the exit speed and allow for pedestrian safety.

SIZE OF CENTRAL ISLAND

The radius of the central island depends on the design speed of the rotary; theoretically it should be the same as that of the entry radius. However, in practice, the radius of the central island is kept slightly more than the entry radius; this is meant to slow down the approaching traffic and give a little preference to the traffic already on the rotary.

This purpose is adequately served by making the radius of the central island 1 1/3 times that of the entry curve. (IRC: 651976).

WIDTH OF CARRIAGEWAY AT ENTRY AND EXIT

This depends on the design traffic entering and leaving the intersection. A minimum of 5 m, with provision for extra width due to curvature, is recommended for the entry and exit.

Table: The recommendations of IRC of Carriageway width

Carriageway width of approach road (m)	Entry radius (m)	Carriageway width of entry and exit (m)
7.0 (2-lanes)		6.5
10.5 (3-lanes)		7.0
14.0 (4-lanes)	25-35	8.0
		13.0
21.0 (6-lanes)		

WEAVING LENGTH

The ease with which the traffic can merge and diverge will be dependent on the weaving length. This is decided based on entry width, the width of weaving section, total traffic volume, and the proportion of weaving traffic in it. If the weaving length is made at least four times the weaving width, direct traffic cuts may be prevented.

IRC: 65-1976 recommends a minimum weaving length of 45 m for a design speed of 40 km/h and 30 m for 30 km/h.

A maximum limit to weaving length is also considered desirable to discourage speeding near the rotary. For this, twice the above values can be taken to be the upper limits.

ENTRY AND EXIT ANGLES

A desirable value for entry angle is 60°; the exit angles should be small for smooth exit from the rotary – it can be 30° or less.

WIDTH OF ROTARY CARRIAGEWAY

Width at entry, width of non-weaving section and width of weaving section are the important elements of the rotary carriageway. The width of the non-weaving section should be at least equal to the widest single entry into the rotary.

EXTERNAL KERBLINE

The external kerb line of a weaving section should be normally re-entrant – either straight or a large radius curve, similar to exit curves. This tends to eliminate wastage of area near the middle of weaving sections, as it is unlikely to be used by traffic.

SUPERELEVATION

The rotary curvature is opposite to that of entry and exit so the super-elevations will be opposite to each other. This causes difficulty to high and heavy vehicles. For the least discomfort the algebraic difference in the cross-slopes should be limited to about 0.07 channelizing islands should be located at the neck. Slight adjustments may be made from the point of view of curvature and speed.

CAPACITY OF ROTARY

Table: According IRC equivalent PCU factors for use in rotary design

S.NO	Type of Vehicle	PCU
1	Cars and light commercial vehicles including 3-wheelers	1.0
2	Buses and medium heavy commercial vehicles	2.8
3	Motor cycle and scooters	0.75
4	Pedal cycles	0.5
5	Animal drawn vehicles	4 to 6

Table: PCU of Medical Chaburah

Time	Bike/cycle	Car/Auto	Heavy Vehicle	Total	PCU
8-9 AM	138	149	14	1131	934
	139	169	16		
	119	123	0		
	122	141	1		
9-10 AM	146	155	12	1234	1002
	141	163	14		
	148	138	3		
	149	164	1		
10-11 AM	155	141	24	1214	992

	171	99	21		
	149	162	1		
	112	149	0		
11-12 PM	161	147	19		
	179	68	23	1077	848
	145	139	1		
	149	45	1		
12-01 PM	155	50	21	829	630
	159	61	26		
	143	41	2		
	141	29	1		
1-2	167	141	23	1155	971
PM	122	144	23		
	119	133	0		
	160	119	1		
2-3PM	148	122	16	1095	911
	122	148	22		
	128	138	0		
	123	128	0		
3-4 PM	155	121	28	1228	987
	240	138	11		
	133	144	1		
	118	138	1		
4-5PM	139	168	13	1550	1117
	268	144	29		
	171	141	0		
	179	156	1		
5-6PM	189	190	23	1320	1063
	170	13	11		
	149	147	2		
	155	144	1		
6-7PM	191	196	17	1323	1056
	183	122	19		
	168	140	2		
	144	141	0		
7-8P	290	291	21	174	1380

M					
	268	249	14		
	166	148	1		
	155	141	1		

DESIGN STEPS

AUTOCAD CIVIL 3D INTERFACE

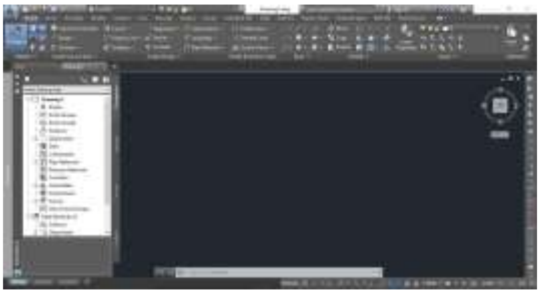

Fig: AutoCAD civil 3D Interface

CREATING SURFACE

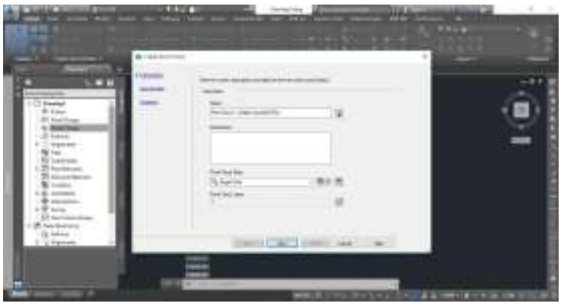

Fig.: Surface created from Point Cloud

Fig: Surface

CREATING ALIGNMENT

Fig: Creating Alignment Road A from object

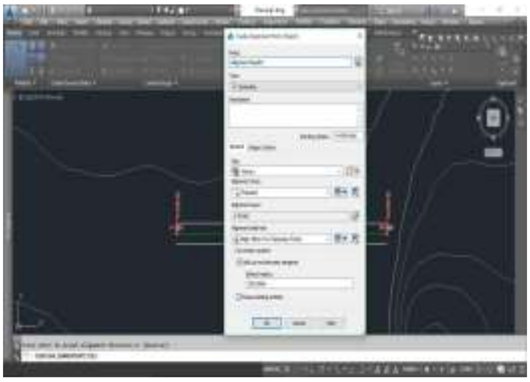

Fig: Creating Alignment Road B from object

Fig: Alignment

CREATING HORIZONTAL PROFILE

Fig: Creating Profile from Surface

Fig: Creating Profile View

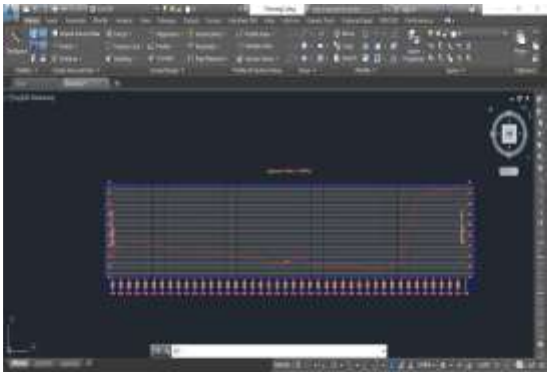

Fig: Horizontal profile of Road A

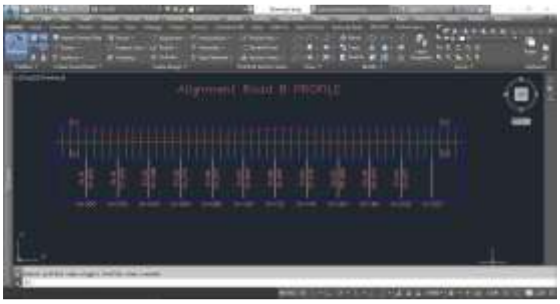

Fig.: Horizontal Profile of Road B

CREATING VERTICAL PROFILE

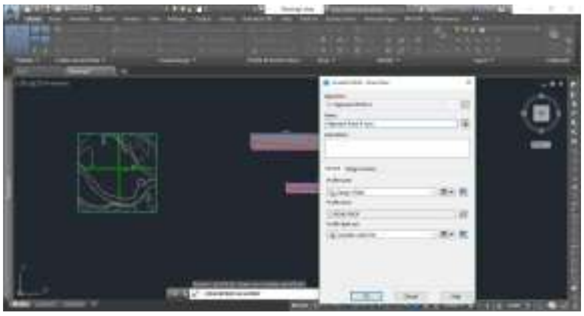

Fig: Creating Vertical Profile

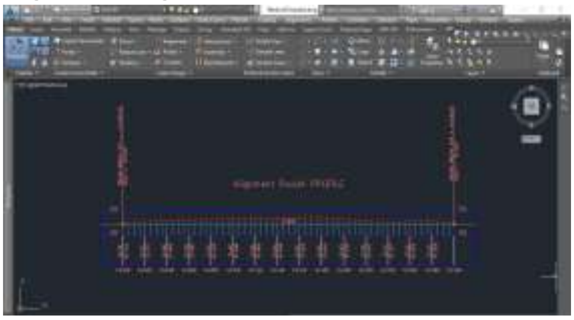

Fig: Vertical Profile of Road A

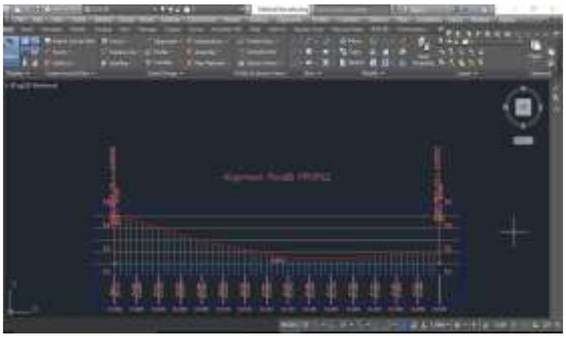

Fig: Vertical Profile of Road B

CREATING ASSEMBLY

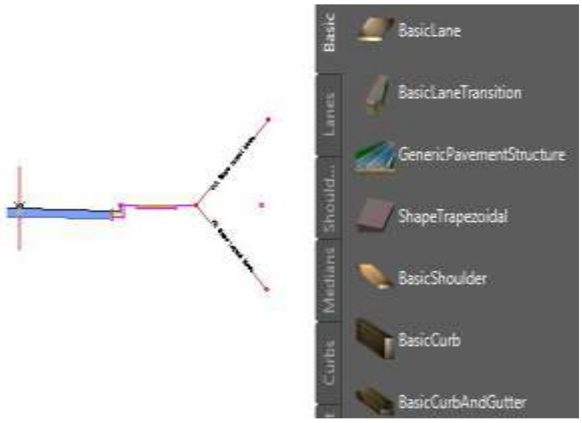

Fig.: subassemblies shown in a tool palette

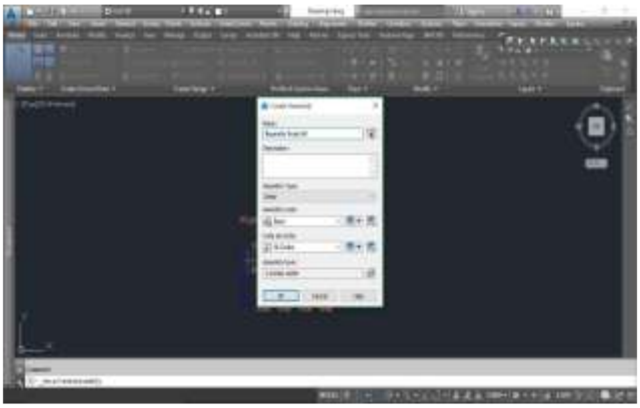

Fig.: Creating Assembly

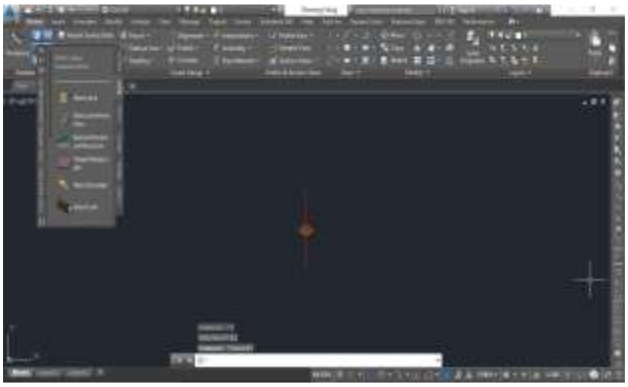

Fig.: Assembly

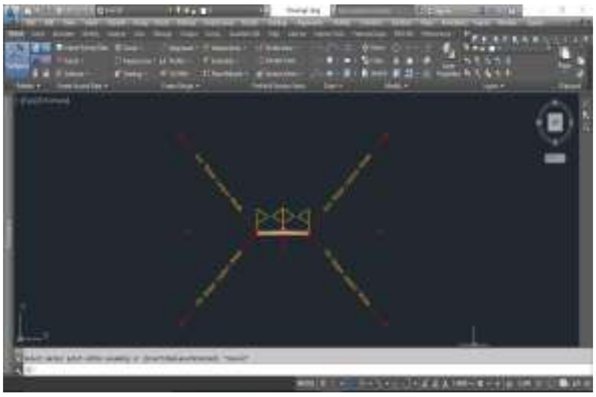

Fig.: Assembly of Road A and Road B

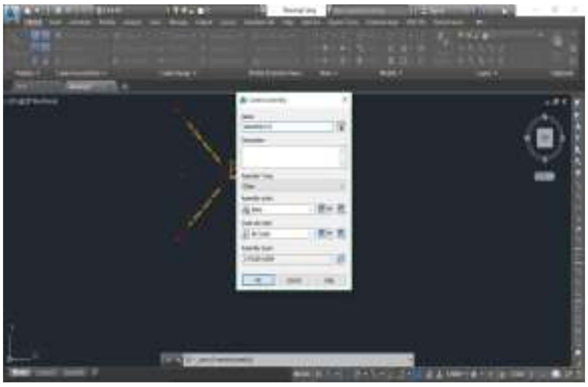

Fig.: Creating Assembly of intersection

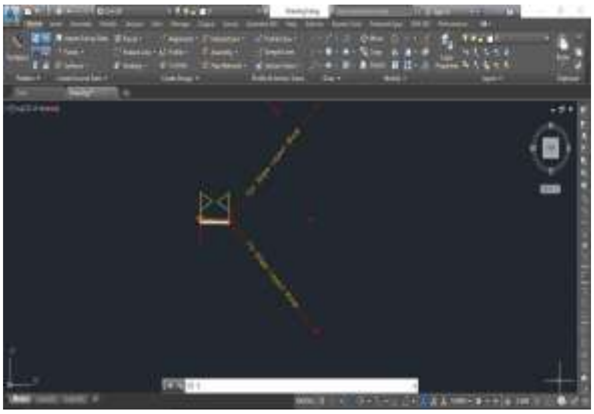

Fig.: Assembly of Intersection

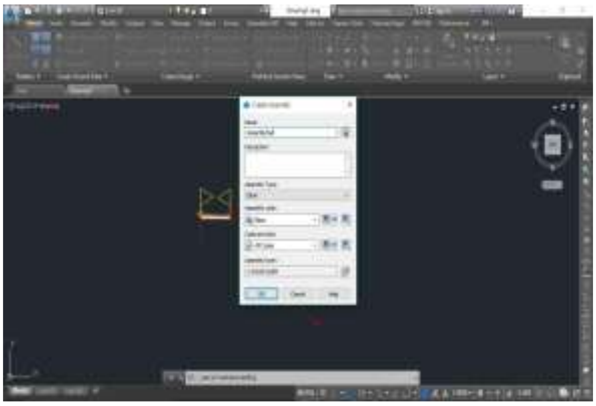

Fig.: Creating Null Assembly

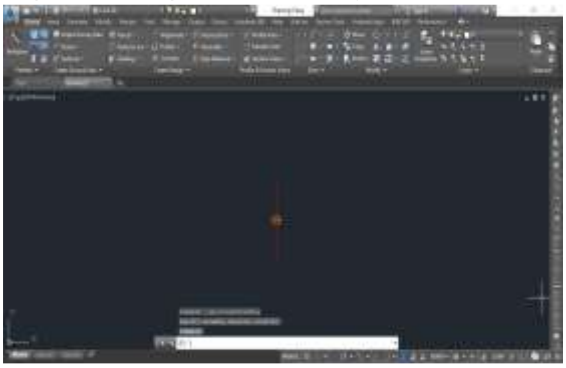

Fig.: Null Assembly

CREATING CORRIDOR

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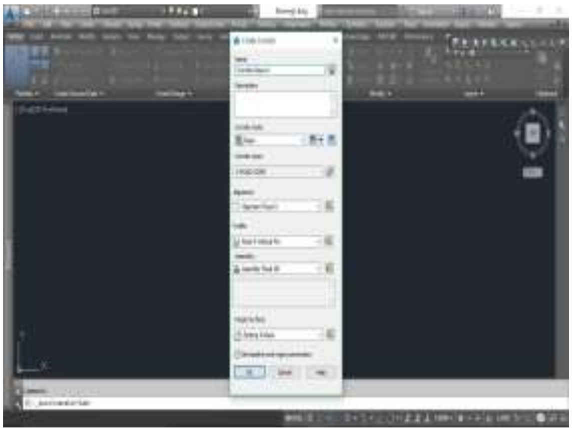

Fig.: Creating Corridor

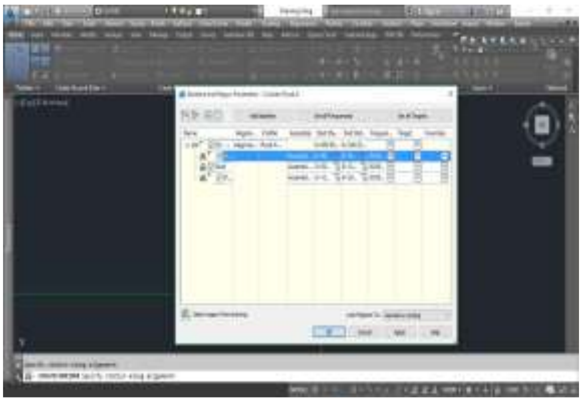

Fig.: Setting of Baselines and Region Parameter of Corridor

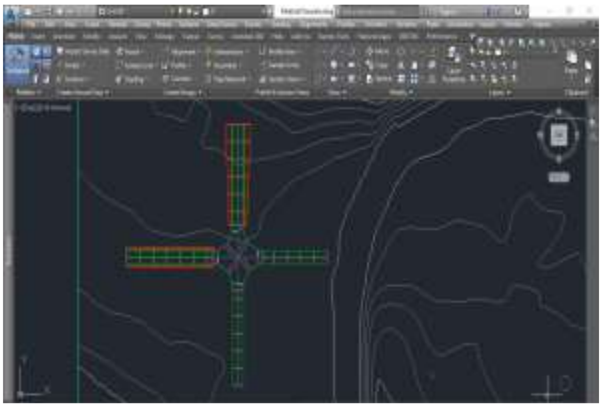

Fig.: Corridor

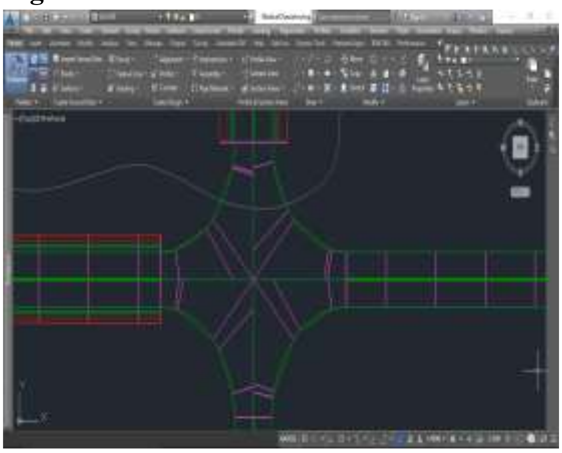

Fig.: Corridor view of Intersection

CREATING ROUNDABOUT

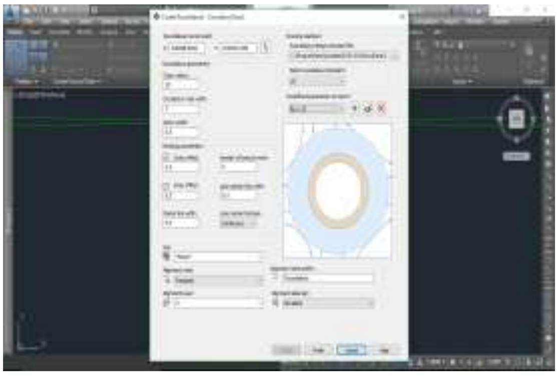

Fig.: Creating Roundabout

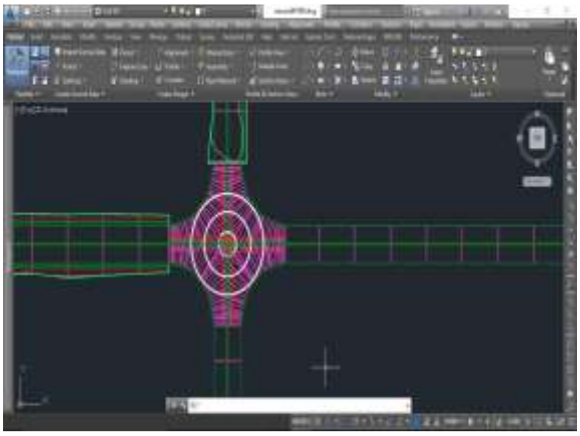

Fig.: Roundabout

TOP VIEW OF THE INTERSECTION

Fig.: Top view of the intersection

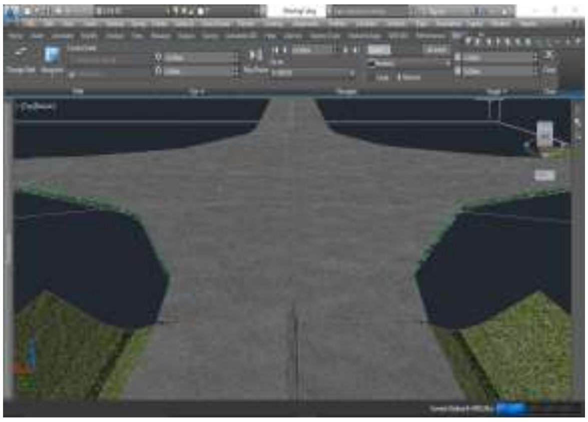

Fig.: Perspective View of Intersection

CREATEING SAMPLE LINES

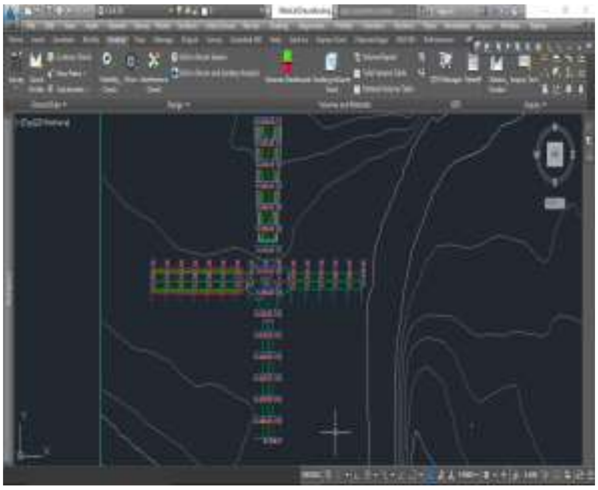

Fig.: Sample Line

CREATING MASS HAUL DIAGRAMS

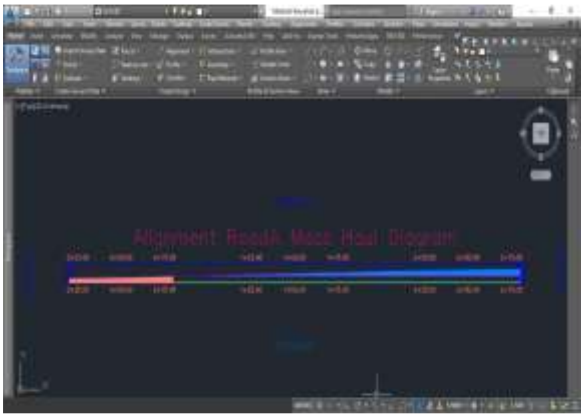

Fig: Mass Haul Diagram of Road A

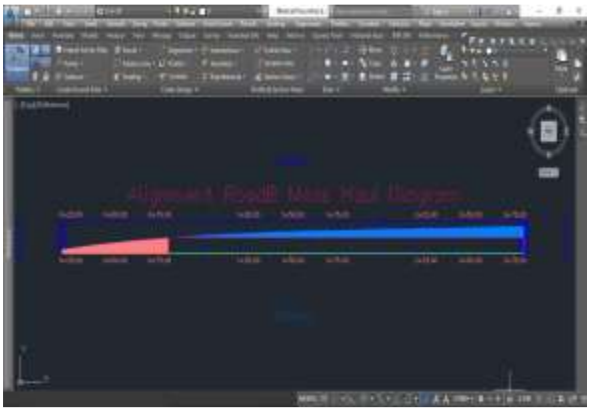

Fig: Mass Haul Diagram of Road

RESULT AND DISSCUSSION

Table: Volume Report of Alignment Road A

Station	Cut Area (Sq.M.)	Cut Volume (Cu.M.)	Reusable Volume (Cu.M.)	Fill Area (Sq.M.)	Fill Volume (Cu.M.)	Cum. Cut Vol. (Cu.M.)	Cum. Reusable Vol. (Cu.M.)	Cum. Fill Vol. (Cu.M.)	Cum. Net Vol. (Cu.M.)
0+020.00	1,185.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

0+040.00	1,217.91	24,035.54	24,035.54	0.00	0.00	24,035.54	0.00	0.00	24,035.54
0+060.00	1,225.99	24,439.05	24,439.05	0.00	0.00	48,474.60	0.00	0.00	48,474.60
0+080.00	1,233.31	24,593.09	24,593.09	0.00	0.00	73,067.69	0.00	0.00	73,067.69
0+100.00	1,245.81	24,791.29	24,791.29	0.00	0.00	97,858.98	0.00	0.00	97,858.98
0+120.00	1,252.21	24,980.20	24,980.20	0.00	0.00	122,839.18	0.00	0.00	122,839.18
0+140.00	1,181.88	24,340.81	24,340.81	0.00	0.00	147,179.98	0.00	0.00	147,179.98
0+160.00	1,061.05	22,429.22	22,429.22	0.00	0.00	169,609.20	0.00	0.00	169,609.20
0+180.00	938.51	19,995.59	19,995.59	0.00	0.00	189,604.79	0.00	0.00	189,604.79
0+200.00	810.48	17,489.90	17,489.90	0.00	0.00	207,094.68	0.00	0.00	207,094.68
0+220.00	783.85	15,943.27	15,943.27	0.00	0.00	223,037.95	0.00	0.00	223,037.95
0+240.00	779.62	15,634.72	15,634.72	0.00	0.00	238,672.67	0.00	0.00	238,672.67
0+260.00	781.20	15,608.18	15,608.18	0.00	0.00	254,280.85	0.00	0.00	254,280.85
0+280.00	782.58	15,637.75	15,637.75	0.00	0.00	269,918.60	0.00	0.00	269,918.60

Table: Volume Report of Alignment Road B

Station	Cut Area (Sq.M.)	Cut Volume (Cu.M.)	Reusable Volume (Cu.M.)	Fill Area (Sq.M.)	Fill Volume (Cu.M.)	Cum. Cut Vol. (Cu.M.)	Cum. Reusable Vol. (Cu.M.)	Cum. Fill Vol. (Cu.M.)	Cum. Net Vol. (Cu.M.)
0+020.00	111.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0+040.00	95.06	2,063.62	2,063.62	0.00	0.00	2,063.62	0.00	0.00	2,063.62
0+060.00	75.23	1,702.90	1,702.90	0.00	0.00	3,766.52	0.00	0.00	3,766.52
0+080.00	56.39	1,316.24	1,316.24	0.00	0.00	5,082.76	0.00	0.00	5,082.76
0+100.00	48.80	1,051.92	1,051.92	0.00	0.00	6,134.68	0.00	0.00	6,134.68

0+120.00	38.17	869.72	869.72	0.00	0.00	7,004.40	0.00	0.00	7,004.40
0+140.00	27.14	653.15	653.15	0.00	0.00	7,657.55	0.00	0.00	7,657.55
0+160.00	18.07	452.17	452.17	0.00	0.00	8,109.72	0.00	0.00	8,109.72
0+180.00	16.28	343.50	343.50	0.00	0.00	8,453.22	0.00	0.00	8,453.22
0+200.00	15.12	314.00	314.00	0.00	0.00	8,767.22	0.00	0.00	8,767.22

Table: Alignment PI Report of Alignment Curve A

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,590.2084m	347,234.1826m		
			30.000m	N90° 00' 00"E
0+030.00	313,590.2084m	347,264.1826m		
			30.000m	N0° 00' 00"E
0+047.12	313,620.2084m	347,264.1826m		

Table: Alignment PI Report of Alignment Curve C

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,575.2084m	347,309.1826m		
			30.000m	N90° 00' 00"W
0+030.00	313,575.2084m	347,279.1826m		
			30.000m	S0° 00' 00"E
0+047.12	313,545.2084m	347,279.1826m		

Table: Alignment PI Report of Alignment Curve D

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,545.2084m	347,264.1826m		
			30.000m	N0° 00' 00"E
0+030.00	313,575.2084m	347,264.1826m		
			30.000m	N90° 00' 00"W
0+047.12	313,575.2084m	347,234.1826m		

Table: Alignment PI Report of Alignment Road A

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,582.7084m	347,105.2818m		
			299.908m	N90° 00' 00"E
0+299.91	313,582.7084m	347,405.1902m		

Table: Alignment PI Report of Alignment Road AL

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,590.2084m	347,105.2818m		
			128.901m	N90° 00' 00"E
0+128.90	313,590.2084m	347,234.1826m		

Table: Alignment PI Report of Alignment Road AL1

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,590.2084m	347,309.1826m		
			96.008m	N90° 00' 00"E
0+096.01	313,590.2084m	347,405.1902m		

Table: Alignment PI Report of Alignment Road AR

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,575.2084m	347,105.2818m		
			128.901m	N90° 00' 00"E
0+128.90	313,575.2084m	347,234.1826m		

Table: Alignment PI Report of Alignment Road AR1

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,575.2084m	347,309.1826m		
			96.008m	N90° 00' 00"E
0+096.01	313,575.2084m	347,405.1902m		

Table: Alignment PI Report of Alignment Road B

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,735.3943m	347,271.6826m		
			299.574m	S0° 00' 00"E
0+299.57	313,435.8207m	347,271.6826m		

Table: Alignment PI Report of Alignment Road BL

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,735.3943m	347,279.1826m		
			115.186m	S0° 00' 00"W
0+115.19	313,620.2084m	347,279.1826m		

Table: Alignment PI Report of Alignment Road BL1

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,545.2084m	347,279.1826m		
			109.388m	S0° 00' 00"E

0+109.39	313,435.8207m	347,279.1826m		

TABLE: Alignment PI Report of Alignment Road BR

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,735.3943m	347,264.1826m		
			115.186m	S0° 00' 00"E
0+115.19	313,620.2084m	347,264.1826m		

TABLE: Alignment PI Report of Alignment Road BR1

PI Station	Northing	Easting	Distance	Direction
0+000.00	313,545.2084m	347,264.1826m		
			109.388m	S0° 00' 00"E
0+109.39	313,435.8207m	347,264.1826m		

CONCLUSION

1. AutoCAD Civil 3D helps to complete the design process in a relaxed and comfortable way within time and also it preserves a lot of time and effort. All curves are the plot in IRC Standard in the project.
2. For every highway design, Intersection Design one can follow AASHTO and IRC guidelines primarily. A state highway specification comes secondary.
3. AutoCAD Civil 3D software is the preferable and optimistic one for designing Intersection. So that it has default values for classification of factors influencing design of Intersection.
4. Optimization of alignment could be done by AutoCAD Civil 3D. So that cost of construction would be less.
5. The use of AutoCAD Civil 3D for rotary intersection design makes the design process to be completed within a very short time and with much ease and amazing precision. These capabilities of AutoCAD Civil 3D eliminate the major disadvantages of the manual design approach that is cumbersome, time consuming and highly prone to costly errors.
6. AutoCAD civil 3D software is helpful, It has a large set of parts and features that choose for designs, It offers powerful and quick dimensions, we use the simplified tools, generate the dimensions to control and expand only the important variables for manufacturing easily.
7. An easy-to-use process that is well integrated into the Autodesk Civil 3D user interface helps to keep you focused on your design.
8. Easily share DWG files created in Autodesk Civil 3D 2016. The software includes an object enabler to ensure that you can manipulate Autodesk Civil 3D objects in any AutoCAD 2016 based application.
9. Define sample lines first by station range, by corridor sections, by selecting multiple points, by existing polylines, and by points, and then specify their left and right offsets.
10. Proper sight distance and vertical alignment can consume less propulsive force leads to low fuel consumption.
11. Rotary have the potential to transform an area. Not only is rotary a radical improvement to a roadway, but rotary can be used as a visual enhancement to an area as a gateway. Rotary are a tool that increases safety

along the street, enhances driver attentiveness, reduces automobile idling, and efficiently streams traffic through an area.

12. Traffic rotaries reduce the complexity of crossing traffic by forcing them into weaving operations. The shape and size of the rotary are determined by the traffic volume and share of turning movements.

13. Rotary are cost effective and safe lots of money that traditional intersections require for the electricity of signals.

14. This crossing area is also lacking with any type of intersection, signs, medians, and other basics safety devices, so I am trying to sort out this problem with design of Intersection.

15. Reduce points of conflict between pedestrians and motor vehicles and are therefore, considered to be safer for them.

16. There would be reduction in accidents due to crossing conflict, notably the right-angled collisions.

17. The Pedestrians can cross the road safely at this intersection.

18. Based on the calculations done on the PCU values obtained from the traffic survey.

19. Reducing the approach speeds of vehicles at the intersection and increasing the exit speeds from the intersection

20. Providing separate storage pockets for right turning traffic at the time of leaving or crossing the main traffic flow.

SCOPE FOR FUTURE STUDY

i. Only three formats of survey data are analysed in the study i.e. total station, auto level and GPS data. Other formats like Topo Maps, Aerial Photograph and Satellite Imagery Remote Sensing may be considered for the future study.

ii. More complex problems like interchange design, and flyovers etc. may be studied to check the capabilities of software in handling complex situations.

iii. Other software like Inroads, Auto Civil 3D and other road designing software available in the market may also be incorporated in future study to recommend the most suitable software in the market.

iv. Fictitious data used can be tested on the actual data.

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